

ISSUES IN MEDICINE

Achieving weight loss and avoiding obesity

Maria Elizabeth Catsicas

The effect of the vast variety of nutrients on metabolic outcome and health is complex. A large number of factors play a role in the type and quantity of food consumed in free-living conditions. It is therefore obvious that prescribing a restrictive diet regimen that favours 1 or 2 nutrients at the expense of the others is a poor tool to manage long-term health and weight.

S Afr Med J 2012;102(9):730-732. DOI:10.7196/SAMJ.6054

Achieving and maintaining a desired body mass index (BMI) is one of the most challenging dimensions in the prevention and treatment of chronic disease. Obesity is a multifactorial condition and not only caused by the over-consumption of refined carbohydrates, but by the complex interaction of biological (metabolism, genetics, appetite), social, economic, environmental (work, stress, time, travelling) and psychological factors (self-perceptions, mood, emotions and motivation).

To combat obesity, most health organisations recommend embarking on an intensive lifestyle intervention using structured patient education and monitoring programmes. These require time and effort and it is understandable that some health professionals offer extreme macronutrient manipulation as an easier solution. High-protein saturated-fat diets have been widely recommended for the past 60 years as they seem to be effective for certain highly motivated individuals. Media attention, diet novelty and doctor enthusiasm can contribute to patient adherence to any type of diet. However, the question is whether following a diet that emphasises a specific macronutrient composition has any advantage towards the treatment of obesity? Diet adherence and behaviour modification (changing of eating habits) are considered as important, if not more so, than the macronutrient composition of the diet itself to long-term success.¹⁻³

Weight loss

The efficacy of diets advocating extreme macronutrient manipulation has been reviewed extensively. Studies involving participation for 12 months or longer revealed that diet adherence, length of intervention and level of calorie

Maria Elizabeth Catsicas is a registered dietician from Nutritional Solutions in Johannesburg.

Corresponding author: M E Catsicas (ria@nutritionalsolutions.co.za)

restriction were far more important than adherence to a very low-carbohydrate regimen. Although obese patients following high-protein low-carbohydrate diets show greater weight loss in the first 6 months, weight-loss differences between diets at 12 months tend to be insignificant. All patients, whether following high- or low-carbohydrate or high- or low-protein and fat diets, transcend to a moderate intake of all macronutrients at the end of 12 months. This is a clear indication that food variety, individual lifestyle constraints and social and cultural aspects need to be addressed when recommending weight-loss strategies.⁴⁻⁸

The importance of fats

Numerous factors apart from low-density lipoprotein (LDL)-cholesterol contribute to cardiovascular disease (CVD). The sub-types of dietary fats, proteins and carbohydrates, and levels of consumption, affect blood fats differently (including triglycerides (TGs), total cholesterol (TC)/high-density lipoprotein (HDL)-cholesterol ratio, LDL-C particle size). Additional factors contributing to risk, in unique ways, include inflammation, weight status, endothelial dysfunction and hypertension.

The South African Heart Association and the Lipid and Atherosclerosis Society of Southern Africa (LASSA) have adopted the European Society of Cardiology (ESC)/European Atherosclerosis Society recommendation that the appropriate strategy to lower LDL-C is to replace saturated and trans-fatty acids (hydrogenated fats) with unsaturated fatty acids. Not only carbohydrates, but the type and quantity of fats have the following effects:

- Saturated fatty acids raise TC, LDL-C and HDL-C depending on the cholesterol and unsaturated fat content of the diet
- Trans-fatty acids raise TC and LDL-C, lower HDL-C, have pro-inflammatory effects and contribute to endothelial dysfunction
- Poly- and mono-unsaturated fatty acids lower TC, LDL-C and TG, without lowering HDL-C.

The substitution of saturated and trans-fats with unsaturated fats rather than carbohydrates is recommended as this contributes to a reduction in small dense LDL-C. Lower-fat and consequently higher-carbohydrate diets raise TG and reduce HDL-C. This is especially important for overweight and obese patients with an atherogenic profile typical of the metabolic syndrome or type 2 diabetes. Although poly- and mono-unsaturated fats have equal effects, the latter have anti-inflammatory properties, and the former may increase susceptibility of LDL-C to oxidation.

The ESC recommends that saturated and trans-fats should not exceed 10% and 1% of total energy intake, respectively. Poly-unsaturated fatty acids should be limited to 10% of energy intake to minimise the risk of lipoprotein peroxidation and HDL-C decrease. A diet of low to moderate fat (30 - 35% total energy), moderate carbohydrates (40 - 45%) and moderate protein (15 - 20%), can thus be beneficial in lowering TGs and raising HDL-C without exacerbating weight or glycaemic control.⁹⁻¹³

The importance of carbohydrates

Weight loss has been shown to improve the atherogenic dyslipidaemia and insulin resistance that occurs concomitantly with abdominal adiposity. This has been achieved with different levels of carbohydrate intake; therefore, it is critical to evaluate the necessity of consuming a very low-carbohydrate ketogenic diet to achieve optimal metabolism. The American Diabetes Association (ADA) designates low- to moderate-carbohydrate diets as 130 g or 26 - 45% of calorie intake per day (2 000 kcal), and very low ketogenic diets as 30 g or 6% of calorie intake per day.

Low-carbohydrate diets can lead to weight and metabolic improvements in the short term (<1 year).¹⁴⁻¹⁶ However, they offer no additional benefits to blood-lipid changes independent of weight loss. Ketogenic and moderate-carbohydrate diets offer equal benefits to weight loss and insulin resistance. However, the use of ketogenic diets is not warranted as they can have adverse metabolic effects and alter energy levels and mood. Reported ketogenic diet side-effects include headaches, constipation and lack of concentration.¹⁷⁻²⁰

Carbohydrate type and quantity contribute more or less equally to the post-prandial glycaemic response. There has always been consensus on the adverse metabolic effects of free sugar and refined carbohydrate over-consumption. However, none of these effects have been observed in the consumption of fresh fruit and vegetables or whole grains. A ketogenic diet does not allow for the adequate intake of these foods, and therefore lacks sufficient provision of fibre, antioxidants, phytochemicals, vitamins and minerals (especially folic acid, magnesium, vitamin E and potassium), all of which are of vital to protection against chronic disease.²¹⁻²³

The importance of protein

Recent studies have shown that the effects of saturated fats on atherogenic lipoproteins may be dependent on protein source and dietary context. Furthermore, findings suggest all processed meats high in saturated fat, sodium, nitrates and phosphates have adverse effects. It has therefore been recommended that processed meats should be avoided, red meat should be limited, and protein from fish and plant sources should be increased.

A meta-analysis of 27 randomised observational trials showed the beneficial effects of a plant-based diet on plasma lipids. TC and LDL-C reductions of approximately 17% and 10 - 15% have been observed with pure vegan and ovo-lacto/semi-vegetarian diets, respectively.²⁵ Nuts contain several bioactive substances such as unsaturated fats, proteins (L-arginine, a nitric oxide precursor), fibre, folic acid, minerals, anti-oxidants and phytochemicals with proven benefit to cardiovascular health. Furthermore, long-term studies have shown that regular fish consumption can lower cardiovascular event rates. The American Heart Association (AHA) recommends a daily intake of 250 mg of C20:5 n-3 eicosapentaenoic acid (EPA) and C22:6 n-3 docosahexaenoic acid (DHA), derived from 2 - 3 portions of fatty fish per week. Compared with no fish consumption, this amount of fatty acids is associated with a 36% lower coronary heart disease (CHD) mortality. Essential fatty acids have additional benefits in reducing inflammation, improving endothelial function, promoting myocardial relaxation and normalising heart rate variability.^{26,27}

1. Artinian NT, Fletcher GF, Mozaffarian D, et al. Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk reduction in adults: a scientific statement. *AHA Circulation* 2010;122:406-441. [http://dx.doi.org/10.1161/CIR.0b013e3181e8edf1]
2. The Diabetes Prevention Program (DPP). Description of Lifestyle Intervention. *Diabetes Care* 2002;25:2165-2171.
3. The Look AHEAD Research Group. Long term effects of a lifestyle intervention on weight and CV risk factors in individuals with type 2 diabetes: four year results of the Look AHEAD Trial. *Arch Intern Med* 2010;270(17):1566-1575. [http://dx.doi.org/10.1001/archinternmed.2010.334]
4. Sacks FM, Bray GA, Carey VJ, Smith SR, et al. Comparison of weight-loss diets with different compositions of fat, protein and carbohydrates. *N Engl J Med* 2009;360(9):859-873. [http://dx.doi.org/10.1056/NEJMoa0804748]
5. Gardner CD, Kiazand A, Alhassan S, Kim S, et al. Comparison of the Atkins, Zone, Ornish and LEARN diets for change in weight and related risk factors among overweight premenopausal women. *JAMA* 2007;297(7):969-977. [http://dx.doi.org/10.1001/jama.297.9.969]
6. Foreyt JP, Salas-Salvado J, Callero B, Bullo M, et al. Weight-reducing diets: are there any differences? *Nutrition Reviews* 2009;67(Suppl 1):S99-S101.
7. Bravata DM, Sanders L, Huang J, Krumholz HM, et al. Efficacy and safety of low-carbohydrate diets: a systematic review. *JAMA* 2003;289(14):1837-1849. [http://dx.doi.org/10.1001/jama.289.14.1837]
8. Franz M, Jeffrey J, Van Wormer MS, Crain L, et al. Weight loss outcomes: a systematic review and meta analysis of weight-loss clinical trials with a minimum 1-year follow up. *J Am Diet Assoc* 2007;107(10):1755-1763. [http://dx.doi.org/10.1016/j.jada.2007.07.017]
9. Mensink RP, Zock PL, Kester ADM, Katan MB. Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: a meta-analysis of 60 controlled studies. *Am J Clin Nutr* 2003;77:1146-1155.

10. Siri-Tarino PW, Sun Q, Hu FB, Krauss RM. Saturated fat, carbohydrate and cardiovascular disease. *Am J Clin Nutr* 2010;91:502-509.
11. Mozaffarian D, Aro A, Willet WC. Health effects of trans-fatty acids: experimental and observational evidence - review. *Eur J Clin Nutr* 2009;63:S5-S21. [<http://dx.doi.org/10.1038/sj.ejcn.1602973>]
12. The Task Force for the management of dyslipidaemias of the European Society of Cardiology (ESC) and the European Atherosclerosis Society (EAS). ESC/EAS Guidelines for the management of dyslipidaemias. *Eur Heart J* 2011;32:1769-1818. [<http://dx.doi.org/10.1093/eurheartj/ehr158>]
13. Kodama S, Saito K, Tanaka S, Maki M, et al. Influence of fat and carbohydrate proportions on the metabolic profile in patients with type 2 diabetes – a meta analysis. *Diabetes Care* 2009;32(5):959-965. [<http://dx.doi.org/10.2337/dc08-1716>]
14. Accurso A, Bernstein RK, Dahlqvist A, Draznin B, et al. Dietary carbohydrate restriction in type 2 diabetes mellitus and metabolic syndrome – a critical appraisal. *Nutrition and Metabolism* 2008;5:9. [<http://dx.doi.org/10.1186/1743-7075-5-9>]
15. Westman EC, William SY, Mavropoulos JC, Marquart M, McDuffie JR. The effect of a low-carbohydrate ketogenic diet versus a low-glycaemic diet on glycaemic control in type 2 diabetes mellitus. *Nutrition and Metabolism* 2008;5:36. [<http://dx.doi.org/10.1186/1743-7075-5-36>]
16. Diabetes UK Position Statement: Low Carbohydrate Diets for People with Type 2 Diabetes. <http://www.diabetes.org.uk> (accessed 25 May 2012).
17. Johnson CS, Tjonn SL, Swan PD, White A, et al. Ketogenic low-carbohydrate diets have no metabolic advantage over non-ketogenic low-carbohydrate diets. *Am J Clin Nutr* 2006;83:1055-1061.
18. Krauss RM, Blanche PJ, Rawlings RS, Fernstrom HS, Williams PT. Separate effects of reduced carbohydrate intake and weight loss on atherogenic dyslipidaemia. *Am J Clin Nutr* 2006;83:1025-1031.
19. Chalasani S, Fischer J. South Beech diet associated ketoacidosis: a case report. *Journal of Medical Case Reports* 2008;2:45. [<http://dx.doi.org/10.1186/1752-1947-2-45>]
20. Fung TT, van Dam RJM, Hankinson SE, Stampfer M, et al. Low-carbohydrate diets and all cause-specific mortality: two cohort studies. *Ann Intern Med* 2010;153(5):289-298. [<http://dx.doi.org/10.1059/0003-4819-153-5-201009070-00003>]
21. Joshupura KJ, Hung H, Li YT, Hu BF, et al. Intakes of fruits, vegetables and carbohydrate and the risk of CVD. *Public Health Nutr* 2009;12(1):115-121. [<http://dx.doi.org/10.1017/S1368980008002036>]
22. Zhu Y, Zhang Y, Ling W, Feng D, et al. Fruit consumption is associated with lower carotid intima-media thickness and C-reactive protein levels in patients with type 2 diabetes. *J Am Diet Assoc* 2011;111:1536-1542. [<http://dx.doi.org/10.1016/j.jada.2011.07.010>]
23. Hur IY, Reicks M. Relationship between whole-grain intake, chronic disease indicators, and weight status among adolescents in the national Health and Nutrition Examination Survey 1999 - 2004. *J Acad Nutr Diet* 2012;112:46-55. [<http://dx.doi.org/10.1016/j.jada.2011.08.028>]
24. Mangravite LM, Chiu S, Wojnoonski K, Rawlings R, et al. Changes in atherogenic dyslipidaemia induced by carbohydrate restriction in men is dependent on dietary protein source. *J Nutr* 2011;141:2180-2011. [<http://dx.doi.org/10.3945/jn.111.139477>]
25. Jenkins DJA, Kendall CWC, Faulkner DA, et al. Assessment of the long term effects of a dietary portfolio of cholesterol lowering foods in hypercholesterolemia. *Am J of Clin Nutr* 2006;83:582-591.
26. Mozaffarian D, Appel L, Van Horn L. Components of a cardio protective diet: new insights. *Circulation* 2011;123:2870-2891. [<http://dx.doi.org/10.1161/CIRCULATIONAHA.110.968735>]
27. AHA Scientific Statement. Diet and Lifestyle Recommendations Revision 2006. *Circulation* 2006;114:82-96. [<http://dx.doi.org/10.1161/CIRCULATIONAHA.106.176158>]

Accepted 18 June 2012.